

AN OUTBREAK OF HEMOLYTIC STREPTOCOCCUS INFECTION IN A BOYS' SCHOOL.

By S. T. NICHOLSON, JR., M.D.,
THE HILL SCHOOL, POTTSTOWN, PA.

On January 29th, 1928, the first instance of the recovery of hemolytic streptococcus in a student convalescent from pneumonia was recovered. Every patient admitted to the infirmary after this was carefully studied and the throat cultured. The hemolytic streptococcus did not put in its appearance again until February 4th, when six boys admitted to the infirmary had positive throat cultures. By March 4th the infection had assumed epidemic proportions and on this date there were over fifty boys in the hospital. One of the students admitted on February 4th died from septic meningitis and one with abscess of the lung following pneumonia eventually recovered. The infection was demonstrated in the spinal fluid of the patient who died from septic meningitis. Between the time of the discovery of these cases and March 4th, eleven convalescent boys had been sent to their homes. Of those under treatment at the school, six had developed otitis media, two ethmoidal infection, two infection of the antrum of Highmore, one erysipelas and one pneumonia. A considerable number of boys were also attending the dispensary for treatment. Several members of the faculty and their families were suffering from similar "colds" and this also applied to the employed help.

A. CLINICAL FEATURES.

The usual symptoms were head cold, sore throat, cough, coryza and fever, usually slight. Of forty-four cases, the first symptom was sore throat in seventeen; nose cold or a cough in seventeen. Four others stated that the sore throat and cough or nose symptoms commenced at the same time. Twenty-four of the forty-four stated that they had headache, either at the onset or later. Twenty-five only had any recorded fever, but high temperatures were uncommon in the uncomplicated cases. In cases with sore throat, the submaxillary lymphatic glands were somewhat enlarged and tender, but this was

not a marked symptom. Two boys complained of soreness on the neck, saying that it hurt to wear a collar. "Grippy pains" were not frequent, although some complained of stiffness of the neck and soreness of muscles. The marked depression so commonly seen in influenza outbreaks was not noticed.

Examination of the pharynx in cases with sore throat usually showed quite intense inflammation, several cases having considerable exudate. All save six of the forty-four examined had had their tonsils removed and this may have caused the throat symptoms to be less severe. The physical signs in the chest were either negative or those of mild bronchitis.

Leukocyte counts showed in general a leukopenia. In the beginning, the counts were usually around 6000. Later cases showed a more marked leukopenia.

Cultures made from the throats showed hemolytic streptococci in nearly every case. In a few there was also a green-producing streptococcus. Organisms of the hemolytic type were predominant in pus obtained in complicated cases. Pfeiffer's bacillus was also present in many of the cultures.

B. EPIDEMIOLOGICAL FEATURES.

The principal epidemiological features were the high proportion of the boys attacked and the comparatively rapid spread through the institution. The extent of the prevalence of hemolytic streptococci among the boys will be appreciated when it is stated that of thirty-six well boys in one of the dormitories cultured on March 6th, twenty-six were found infected. The high proportion of well and sick infected with hemolytic streptococci was remarkable. The disease was as frequent among the older as among the younger boys.

Between the fourth and the twentieth of February, one boy developed an acute mastoid. After the twentieth, fifteen boys developed serious complications; in all save one, a case of type II pneumonia, hemolytic streptococcus was recovered in the cultures.

In reviewing the dispensary records of the fall term, it was found that in a considerable number of cases diagnosed influenza, quite low leukocyte counts had been found. Such cases of sore throat and tonsillitis as occurred in the fall were due to non-hemolytic types.

It would seem quite reasonable to believe, therefore, that the

hemolytic streptococcus infection was introduced after the Christmas vacation.

MILK NOT A FACTOR IN THE PRESENT EPIDEMIC.

So many cases of sore throat and a proven streptococcus hemolyticus infection naturally directed suspicion to the milk supply. It should be noted, however, that clinically these cases were not such as are usually found in milk-borne epidemics of septic sore throat. In the latter the cases are much more severe with a higher proportion of serious complications and a leukocytosis is the rule. The initial symptom in this group was, in the great majority of cases, an intense pharyngitis. On clinical grounds, septic sore throat could be practically ruled out.

The milk supply of the School is obtained from tuberculin tested herds. It is pasteurized and delivered to the School in large cans (40 quart containers).

The dairy received on the average 17,000 pounds of milk daily, of which one third came from "A" shippers. The grade A milk was supplied to the following customers: The Hill School, 450-500 qts. daily; sanitarium and hospitals, 410 qts. daily; general public, 600 qts. daily.

It seemed scarcely possible that an outbreak as extensive as that at the School could have been due to milk and that other consumers of Grade A from the same source did not reveal unusual prevalence of sore throats. The records of the local registrar of vital statistics for Pottstown were then searched, particularly for evidence of any unusual mortality from pneumonia, peritonitis, erysipelas, etc., as well as for septic sore throat, and comparison was made with the year previous. Nothing unusual was found. Similarly, evidence was sought from the public school records and from the public school physician and nurse. No evidence was found of an unusual number of absences on account of sore throat, although there was at the time an epidemic of German measles in the town. It was therefore concluded that there was no epidemiological evidence incriminating the milk supply.

Clinically the disease resembled mild influenza, the respiratory symptoms and the leukopenia pointing definitely to this diagnosis. Epidemiologically the outbreak also resembled influenza in the high

proportion of the boys attacked and in the rapid spread through the institution.

The complications were due to the hemolytic streptococcus, as is usual in influenza. The fact that so few serious pulmonary infections occurred may be attributed to the spacing-out policy and to the medical care which the boys received.

C. PROCEDURE.

Extension of isolation and the spacing-out policy already adopted, were promptly put into effect. About seventy-five boys, convalescent, were sent to their homes and all those reporting sick were sent to the infirmary. Laboratory facilities had to be extended, a nose and throat man and a consulting internist were provided for daily rounds. Twenty-four hour dispensary service was instituted and special trained medical help was provided for the hospitals. Some of the dormitories were turned into emergency hospitals, with a complete staff of nurses. This provided for the spacing-out as above mentioned. As a result, the outbreak almost immediately ceased, and in a few days throat infections with streptococcus hemolyticus disappeared.

FREQUENCY OF COLDS, ETC.: FALL AND WINTER TERM.

Throwing together all respiratory infections, the dispensary records show that between January 5th and March 7th, inclusive, there occurred four hundred and fourteen attacks, of which two hundred and forty-three occurred after February 1st. This high sickness rate led to the examination of the statistics of the fall term also. It was found that during the fall term there had been three hundred and forty-two such attacks. These attacks are shown by day of first attendance at the dispensary in Table A. It should be noted that all diagnoses such as "colds," "rhinitis," "bronchitis," "pharyngitis," etc., have been included, and secondly, that a new attack is presumed to have occurred when a boy, after an interval of fourteen days or more from last attendance, reported at the dispensary on a second, third or subsequent occasion. The chronological occurrence of these respiratory infections down to March 7 is indicated on the accompanying graph.

The most interesting feature in this graph is the evidence of four

outbreaks; one in October; a lesser one later in the fall term; a third on return to school in January and the final outbreak which apparently started on January 29th. Many boys were granted leave over this week end.

A more detailed study was made of six hundred and seventy-three attacks occurring up to February 29th. It was found that these attacks were distributed among three hundred and twenty-five boys as follows:

1 boy had 6 attacks.
 3 boys had 5 attacks.
 24 boys had 4 attacks.
 81 boys had 3 attacks.
 97 boys had 2 attacks.
 119 boys had 1 attack only.

325

Now if the average enrollment of pupils be taken as four hundred and twenty-six, it is seen that one hundred and one boys had had no colds to this date. Some of these, however, were later attacked.

Particular attention is directed to those having numerous "colds." The twenty-eight worst sufferers, for example, had between them one hundred and seventeen attacks.

$$(1 \times 6) + (3 \times 5) + (24 \times 4) = 117$$

The number of admissions to the infirmary from respiratory causes had been quite high. The records show the following numbers:

	Fall Term	Winter Term	Spring Term
1924-25	34	18	34
1925-26	106	120	21
1926-27	167	150	67
1927-28	108

For the most part, these conditions were mild and no outbreak with such serious complications as the present had occurred since careful records have been kept.

In studies of the U. S. Public Health Service, college students have been shown to suffer quite considerably more than the general population from coughs and colds, averaging about two per student per annum. These colds had two time peaks, one in October and the other in January and February.

CONCLUSIONS AND RECOMMENDATIONS.

There are some procedures which may quite reasonably be expected to reduce the chance of such an occurrence or at least reduce the probability of severe and fatal complications. These procedures have been in effect from 1928 to the present time with certain limitations. Although there has been no repetition of such an outbreak, I feel that it is due to the absence of the "cycle" rather than to preventive procedures.

A. CONCERNING THE INTRODUCTION OF INFECTION.

This, of course, cannot be avoided. In the circumstances under which any such school must operate, the pupils are collected from many parts of the country three times a year. These boys will naturally bring with them the infections prevalent in the localities from which they come. That the incidence of respiratory diseases increases immediately following the commencement of a school term is suggested by the accompanying graph.

The question naturally arose as to the extent to which it is justifiable to exercise restraint with respect to the contact of the boys with the general population, either through (a) week end or other leave or (b) the introduction of a large number of visitors.

The accompanying graph might be interpreted as indicating a rise following the dance or the week end leaves granted at the mid-term. We have been more liberal with week end leaves in the spring term than in the winter and fall terms. Boys returning from week end leaves are required to report at the dispensary each day for three days. In this way, cases among them are detected early. Week end leaves are not granted promiscuously, but a certain number are obviously necessary.

Concerning the introduction of a large number of visitors, dances in the spring term and just before the Christmas vacation are now the rule, with smaller house parties in the winter term.

B. CONCERNING THE SPREAD OF INFECTION WITHIN THE SCHOOL.

First, the *isolation* of early cases of coughs, colds and sore throats when possible. It is quite reasonable to believe that such prompt isolation helps to prevent such a widespread streptococcus infection as that under discussion.

These remarks concerning isolation are intended to apply not only to the boys, but to the faculty and their families and to the help. It is of course obvious that it is quite useless to isolate the boys, and allow other groups with whom they are in contact to go without restraint. The waitresses and other help are under the care of the medical staff, again with unavoidable exceptions, but the School Medical Director endeavors to avail himself of information concerning the health of the personnel.

The second general consideration was that of the prevention of crowding of the boys. Any herding together in rooms, dining halls or indoor assemblies was calculated not only to spread such infections, but probably to increase their virulence.

These two general procedures, namely, strict isolation of early cases, and a general policy of provision of more space for boys and help, were among other things our most valuable measures of prevention.

Attention has been directed to those boys who suffer from repeated colds. In this group there were twenty-eight, which is a fair percentage of groups in previous and subsequent years compared to the total enrollment. This approximate percentage of boys certainly in a group comprising the pre-adolescent, adolescent and post-adolescent ages such as are found in a secondary school, are the ones that cause us our chief concern. It is safe to say that the majority of a student body seldom visit the dispensary or the infirmary and it seems that an extensive department must be maintained for a relative few.

The removal of defects as might occur in the nose and throat and elsewhere, the avoidance of fatigue, insistence on sleep, the regulation of diet, determining the cause of unhappiness, if any, and a study of infractions of discipline, all of which summed up, leads us to conclude that the socially mal-adjusted boy is not only the chief problem of institutions that govern the formative period of their lives, but it is a correction of this general environmental social life that adds to the resistance of disease.

In conclusion, thanks are due to Dr. J. A. Douhl, of the School of Hygiene of the Johns Hopkins Medical School, who aided this study so effectively.

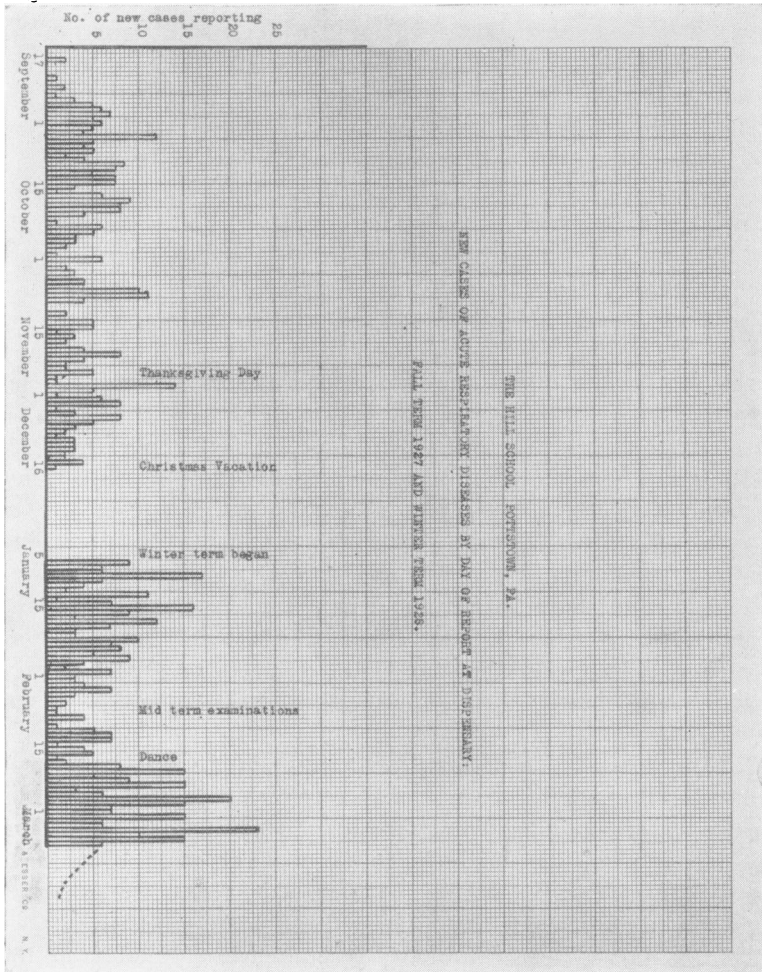


TABLE A.

The Hill School, September 15th, 1927-March 7th, 1928.

Number of cases of acute respiratory disease according to date of report at dispensary. All cases diagnosed "cold," rhinitis, coryza, pharyngitis, tonsillitis, influenza, bronchitis and pneumonia are included. (A new attack is one which has occurred only after an interval of fourteen days or more since last report at dispensary.)

Day	Sept.	1927 Oct.	Nov.	Dec.	Jan.	1928 Feb.	Mar.
1 . . .	0	6	0	6	0	3	7
2 . . .	0	5	2	8	0	4	15
3 . . .	0	4	3	1	0	7	6
4 . . .	0	12	0	3	0	3	6
5 . . .	0	5	4	8	0	0	23
6 . . .	0	4	0	5	9	2	10
7 . . .	0	5	10	3	6	1	15
8 . . .	0	2	11	2	6	1	0
9 . . .	0	4	4	1	17	4	0
10 . . .	0	9	0	3	6	0	0
11 . . .	0	8	0	3	4	1	0
12 . . .	0	5	2	3	2	5	0
13 . . .	0	8	0	2	11	7	0
14 . . .	0	8	5	2	1	7	0
15 . . .	0	3	5	4	7	1	0
16 . . .	0	1	1	1	16	4	0
17 . . .	2	6	3	0	9	5	0
18 . . .	0	9	2	0	3	1	0
19 . . .	0	8	0	0	12	2	0
20 . . .	0	8	4	0	7	8	0
21 . . .	1	4	8	0	3	15	0
22 . . .	0	0	4	0	3	5	0
23 . . .	2	1	2	0	10	9	0
24 . . .	0	6	2	0	7	15	0
25 . . .	1	5	5	0	8	3	0
26 . . .	3	3	1	0	5	6	0
27 . . .	5	3	1	0	9	20	0
28 . . .	6	2	14	0	4	15	0
29 . . .	7	0	5	0	2	7	0
30 . . .	5	1	1	0	7	0	0
31 . . .	0	6	0	0	3	0	0
Total	32	151	99	55	177	161	82

DISCUSSION.

DR. FRANK A. EVANS: Dr. Nicholson in giving his attention to, and in calling our attention to respiratory tract infections, it seems to me, has entered into a big responsibility which the medical profession will have to assume. When I contemplate the high percentage of disabilities which we see in our offices which can be traced directly to the subject dealt with in the last two papers, unconditioned reflexes and upper respiratory tract infections, I am appalled. Certainly if we could control them we could probably all live to be one hundred years of age. Certainly in the atmosphere in which we live in Pittsburgh, with its noxious smoke and odors, if something is not done soon about both of these I fear that our urban civilization is going to be threatened.

Every year it seems to me that the number and severity and the incidence of common colds are getting worse and that this is a real serious menace. Some of my colleagues, who have discussed the matter in Pittsburgh, feel that we are not going to solve this problem by any one discovery or one point of view, but more by such observations as Dr. Nicholson has given us, by bringing to bear upon them a number of different things in control of these upper respiratory tract infections by the same methods and control as in tuberculosis has brought that dread disease under control.

In regard to treatment, as with these emotional reactions, the positive treatment of course is unsatisfactory. At present, it seems to me, that in these emotional disorders our ideas of treatment should be to refrain from doing the wrong thing. So often we see injudicious therapy doing harm by fixing the neuroses or causing the symptoms of one neurosis to disappear by inducing others, by fixing the neurotic tendency.

In regard to the upper respiratory tract infections, I would like to put as a question whether or not it is wise to run to the nose and throat man immediately upon the beginning of congestion in the nose and throat. We have been wondering at home whether by interfering with the normal flow we perhaps are not lowering the local resistance to infection and, therefore, inviting more invasion.

The causes of these colds Dr. Nicholson has touched upon. I think I would emphasize certainly in adults the influence of fatigue, emotional rather than physical, the maladjusted boy, the worn business executive. The rôle that the streptococcus plays is to my mind very questionable in these upper respiratory tract infections. At the same period of this epidemic that Dr. Nicholson reported we had one in Pittsburgh which, because of its pain and severity, we were inclined to consider as a minor "flu" epidemic. We could grow from all throats cultured a hemolytic streptococcus without complication. We never grew any streptococcus from the blood with complications. In a high percentage of cases we could grow a streptococcus from the blood, but always a non-hemolytic streptococcus. That was confusing.

Somewhat more confusing was the fact that we had in all our complications no evidence of kidney lesions. Following the suggestion of a paper by

Dr. Houghcamp, we cultured the urines of a number of our colleagues once a week. We had six doctors in the series. In those urines there was no sign of a real lesion at all. We could recover a streptococcus almost regularly over periods of six months.

In closing my discussion I would like to ask Dr. Nicholson if he saw any evidence of kidney irritation in his series or any series in which he saw signs.

Also in the series of colds which we see throughout the winter, they all seem to run in one type in November, another in December, another in March, and so on. Let us say the first series, or a large percentage of them, all run to bronchitis, the next series run to the sinuses, and the next will perhaps run to pharyngitis, with enlargement of the glands. Of course, we are not in a position to follow that up and get a real impression on that type of thing very much, but Dr. Nicholson is, perhaps, and I would like to ask him if he, too, has noticed any such systematic distribution of the character of these colds.

DR. NICHOLSON: That was more or less of a summary, and in trying to make it as short as possible I didn't bring in many of the things that we tried to work out and that Dr. Evans has so forcibly emphasized.

We did not find an instance of kidney irritation in this large group that we studied. We have a certain group of boys always in school, I should say in the neighborhood of 1 per cent, who show evidences of renal irritation. Many of them, no doubt, are the so-called orthostatic type, but many also show cells and casts which show irritation, but there was no increase of this condition in this epidemic.

I quite agree, too, that even the least handling or application to a nose and throat of these acutely inflamed mucous membranes is certainly productive of more harm than good, aside from, perhaps, just a mild normal salt solution, certainly nothing stronger.

After a study of the types of cold for a period of years, I should answer in the affirmative Dr. Evans' question. One month the type runs bronchitis, then the next month, without any perceptible change and almost overnight, it will change to pharyngitis, or to a rhinitis type, and there is a constant cycle of the upper respiratory infections doing just exactly what he described.